

## **REINFORCER FOR WRAPPED BAND FRICTION HINGES**

This invention claims priority of provisional application No. 60/492,858 filed August 4, 2003. The invention is directed to a reinforcing element suitable for wrapped band friction hinges.

### **BACKGROUND OF THE INVENTION**

Friction hinges are used for positioning display screens in lap-computers, medical equipment and video monitors in automobiles as well as many other applications. A commonly used method for making friction hinges utilizes a single turn of a wide spring material tightly fitted over a round shaft. One attachment to this type of hinge is made to the shaft, and the other is made to the tail, or end, of the flat spring material which extends tangentially from the circular wrap about the shaft.

This method is inexpensive and capable of providing good performance and reasonably long life. But it has the disadvantage that the tail of the flat spring material flexes under bending loads as the display is moved from one position to another. Such bending makes it difficult for the user to position the display accurately.

One prior art method for reinforcing the flat portion of the band consists in forming ridges or bending ribs into the band during forming. These methods do stiffen the band, but they make it much more difficult to form the band accurately, with the result that the frictional characteristics of the hinge are not as controllable.

Another method for stiffening the band uses a separate rib, perpendicular to the band, and attached to the flat portion of the band along one of its edges. The prior art includes an attachment method consisting of tabs formed as a part of the band which engage slots in the reinforcing rib. Failures of this method occur when the reinforcing rib moves so as to lose its engagement with the tab of the band.

Accordingly, it would be desirable to provide a method for ensuring permanent and firm attachment of the reinforcing rib to the edge of the band without incurring significant extra cost in tooling, material, or assembly labor.

## SUMMARY OF THE INVENTION

Generally speaking, in accordance with the invention, an improved friction hinge assembly is provided. The friction hinge assembly includes a rotatable shaft and a band having a circular spring portion for defining an opening in which the shaft is rotatably inserted in order to provide frictional torque between the shaft and the band spring portion. The band also includes a substantially flat tail portion having at least one edge.

Significantly, when the shaft is fully inserted within the spring portion opening, it urges a reinforcing rib to abut against the edge of the tail portion of the band.

- 10 This prevents flexing of the tail portion when the spring portion of the band rotates relative to the shaft.

In accordance with the invention, the construction of the reinforcing rib and the band prevents movement of the reinforcing rib away from the edge of the band's tail portion even when the shaft is partly retracted away from within the spring portion opening. In particular, the edge of the tail portion includes at least one tab for selective reception through at least one corresponding slot formed in the reinforcing rib. At least one of the tabs which depends from the edge of the band tail portion is formed with a hook element. This hook element is designed for grabbing a portion of the reinforcing rib once the tab is received through said corresponding slot that is formed in the reinforcing 20 rib. As a result, rib movement is prevented.

In its preferred design, the inventive hinge assembly has the reinforcing rib formed with an opening through which the shaft passes therethrough when inserted in the opening of the spring portion of the band. Notably, the opening of the reinforcing rib and the opening of the spring portion of the band are designed to be unaligned when the 25 depending tab of the tail portion edge is received through its corresponding slot in the rib. On the other hand, the rib opening and the opening of the spring portion are in an aligned condition once the hook element of the depending tab grabs a portion of the reinforcing rib – this is achieved by adjusting the relative position of the reinforcing rib with respect to the tail portion of the band.

Accordingly, it is an object of the invention to provide an improved friction hinge assembly.

It is another object of the invention to provide an improved friction hinge assembly which ensures permanent and firm attachment of a reinforcing rib along the edge of the band tail portion.

Another object of the invention is to provide an improved friction hinge assembly which prevents flexing of the tail portion of the band due to bending loads as the hinge display is moved from one position to another.

Still other objects and advantages of the invention will, in part, be obvious and will, in part, be apparent from the following description.

### **BRIEF DESCRIPTION OF THE DRAWINGS**

Further understanding of our invention will become apparent upon consideration of the following detailed description in conjunction with the drawings, in which:

FIG. 1 is a perspective view which shows the prior art design of stiffening with a perpendicular rib attached by straight tabs that extend from an edge of the band;

FIG. 2 is a front perspective view which depicts the prior art stiffening design show in FIG. 1 in a failed condition;

FIG. 3 is a perspective view which shows the inventive hinge fully assembled with its stiffener in place;

FIG. 4 is an exploded perspective view of the band, stiffener and shaft of the inventive hinge;

FIG. 5 is an exploded perspective view which shows the stiffener engaging the band, but not yet in its final position;

FIG. 6 is an exploded perspective view which depicts the stiffener in its final position and ready for reception of the shaft; and

FIG. 7 is an exploded perspective view which illustrates one alternative embodiment of the inventive hinge.

## DETAILED DESCRIPTION

Referring now to FIG. 1, a hinge of the prior art that uses a separate stiffener is shown. The hinge is comprised of band 1, shaft 3 and stiffener 5. Band 1 has a tab 7 extending therefrom into slot 9 of stiffener 5. Band 1 includes a circular spring portion 11 into which shaft 3 is inserted. Shaft 3 holds stiffener 5 in position against the edge of the band only so long as shaft 3 remains fully inserted within circular portion 11. If, during repeated operations of the hinge, shaft 3 becomes slightly retracted from circular portion 11 of band 1, then stiffener 5 can assume the position shown in FIG. 2, wherein tab 7 has been disengaged from slot 9 so that band 1 is no longer stiffened by means of stiffener 5.

The preferred embodiment of the hinge of our invention is shown assembled in FIG. 3 and FIG. 4. Band 15 has two tabs 23, 25 depending from the edge thereof for engaging slots 19, 21 in stiffener or rib 17. Stiffener 17 has two slots, first slot 19 and second slot 21, for engaging tabs 23 and 25 respectively of band 15. Shaft 13 has turned down portion 27 which fits, with slight clearance, through hole 29 in stiffener 17, and into the tightly fitting, friction producing opening 33 of circular spring portion 31 formed at one end of band 15.

As can be seen in FIG. 4, shaft 13 is aligned with opening 33 in circular spring portion 31 of band 15. But hole 29 in stiffener 17 is not in alignment. As shown in FIG. 5, it can be seen that hole 29 of stiffener 17 is out of alignment with shaft 13 and opening 33 in band 15. In order for hole 29 and opening 33 to align, it is necessary to move stiffener 17 laterally over tabs 23 and 25 and then move it vertically upward until the holes are aligned. This is shown in FIG 6, where it can be seen that stiffener 17 has been moved to engage hooks 35 and 37 of engaging tabs 23 and 25 with stiffener hole 29 aligned with both turned down portion 27 of shaft 13 and opening 33 in the circular portion 31 of band 15. Hooks 35 and 37 of engaging tabs 23 and 25 are so configured that stiffener 17 fits snugly into the space therebetween and the body of band 15. Importantly, slots 19 and 21 of stiffener 17 must be sized to permit tab 23 with its hook 35 and tab 25 with its hook 37 to pass respectively therethrough. Then, when stiffener 17 is moved to align hole 29 with opening 33 of circular portion 31, hooks 35 and 37 overlap the material of stiffener 17 at the ends of each of the slots.

With hole 29 in stiffener 17 and opening 33 in the circular portion 31 of band 15 in alignment, turned down portion 27 of shaft 13 can be fully inserted into the assembly, thereby locking stiffener 17 and band 15 together.

An alternative configuration of the invention is shown FIG. 7. In this 5 embodiment, two tabs 39 and 41 are used to engage slots in stiffener 45. But only tab 39 has a hook 47. Tab 41 is formed without a hook to simplify the stamping operation. The result is that the engagement of stiffener 45 and band 43 is slightly less secure than in the embodiment of Figs. 3-6.

It is also possible to use our invention with only a single tab, as in the 10 hinge of FIGS 1 and 2, but with the addition of a hook to ensure the engagement of the stiffener and the band. But this arrangement will probably provide reduced stiffness compared to the use of two tabs and is this less preferred.

It will thus be seen that the objects set forth above among those made apparent from the preceding description are efficiently attained and, since certain changes 15 may be made in the construction of the invention without departing from the spirit and scope of the invention, it is intended that all matter contained in the above description and shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover 20 all of the generic and specific features of the invention herein described and all statements of the scope of the invention, which, as a matter of language, might be said to fall therebetween.

Parts	Fig.	Name used
1	2	band – prior art
3	1,2	shaft – prior art
5	1,2	stiffener – prior art
7	1,2	tab – prior art
9	1,2	slot – prior art
11	1,2	circular portion – prior art band
13	3,4	shaft – preferred embodiment
15	3,4,	band – preferred embodiment
17	3,4	stiffener – preferred embodiment
19	3,4	first slot – preferred embodiment
21	3,4,	second slot – preferred embodiment
23	3,4	first tab – preferred embodiment
25	3,4	second tab – preferred embodiment
27	3,4	turned down portion – shaft – preferred embodiment
29	3,4	clearance hole in stiffener – preferred embodiment
31	3,4	circular portion of band – preferred embodiment
33	3,4	hole in circular portion of band – preferred embodiment
35	3,4	hook of first tab – preferred embodiment
37	3,4	hook of second tab – preferred embodiment
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